MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2019/2020**

## DCA5038 – NETWORK ANALYSIS

(Diploma in Electronics Engineering)

16 OCTOBER 2019
9.00 A.M – 11:00 A.M
(2 Hours)

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**INSTRUCTIONS TO STUDENT**

1. This question paper consists of 7 pages excluding the cover page.
2. Answer ALL questions. All necessary working steps must be shown.
3. Write all your answers in the answer booklet provided.

**QUESTION 1 [20 marks]**

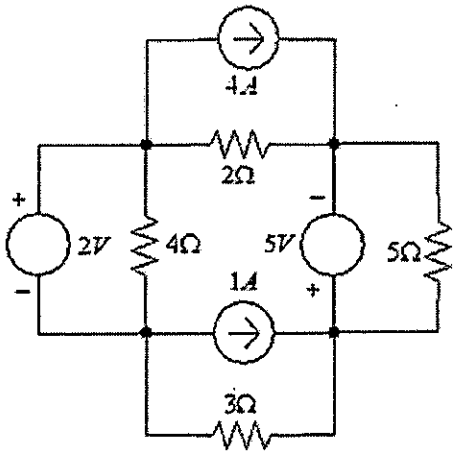


Figure 1(a)

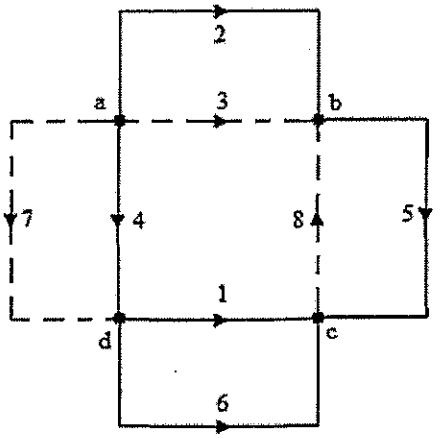


Figure 1(b)

Figure 1(a) shows an electric circuit network. Using proper tree in Figure 1(b), determine all the voltage and current for each edge of the tree using **f-loop method** only. Write the answer for each current and voltage of the edges up to **3 decimal points** neatly in a column.

(20 marks)

**Continued...**

**QUESTION 2 [20 marks]**

(a) Figure 2 shows an electrical signal, $x(t)$. Draw the signal $-x(t)$ and find both of its odd and even components.

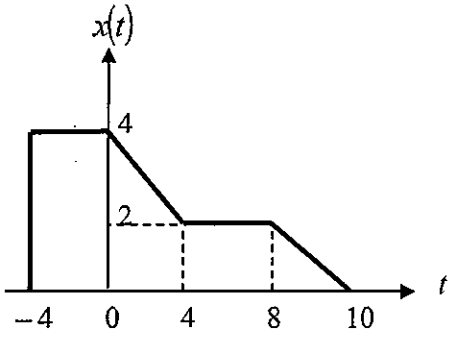


Figure 2

(14 marks)

(b) Define the characteristics of a:

i) Tree

(3 marks)

ii) Cotree

(3 marks)

**Continued...**

**QUESTION 3 [20 marks]**

A series RC circuit is shown in Figure 3. Given $V_c(0)=2V$, find current across the capacitor in *t*-domain. $i(t)$

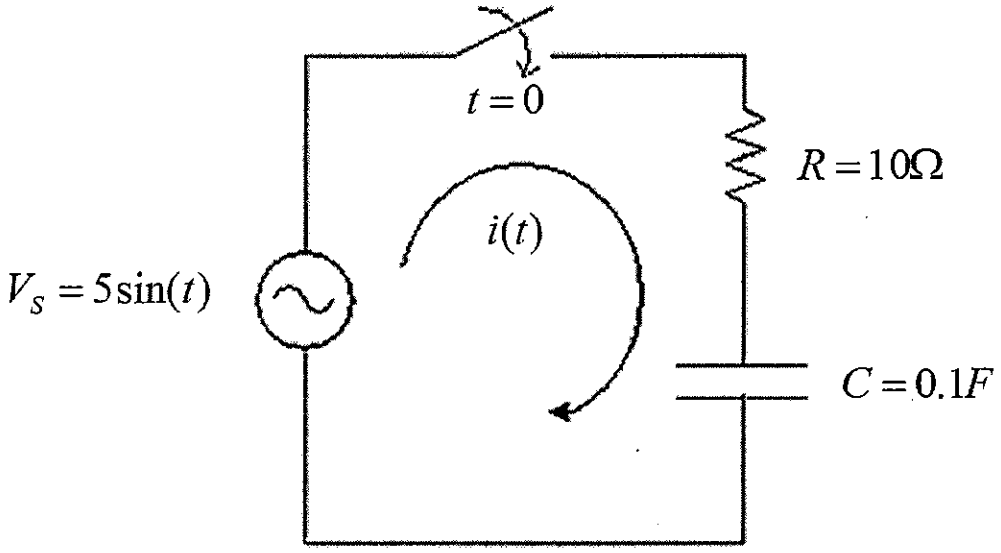


Figure 3

(20 marks)

**Continued...**

**QUESTION 4 [20 marks]**

(a) Figure 4(a) shows a T-network diagram. Calculate the Z-parameter and draw the Z-parameter equivalent circuit.

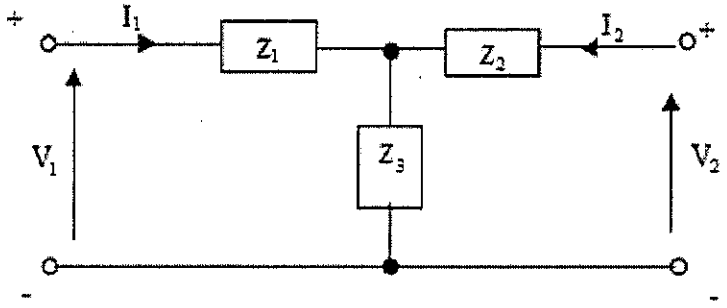


Figure 4(a)

Given $Z_1 = (1 + j2)\Omega$;
$Z_2 = 2\angle -90^\circ \Omega$;
$Z_3 = (8 + j9)\Omega$.

(10 marks)

(b) Figure 4(b) shows a π-network diagram. Calculate the Y-parameter and draw the Y-parameter equivalent circuit.

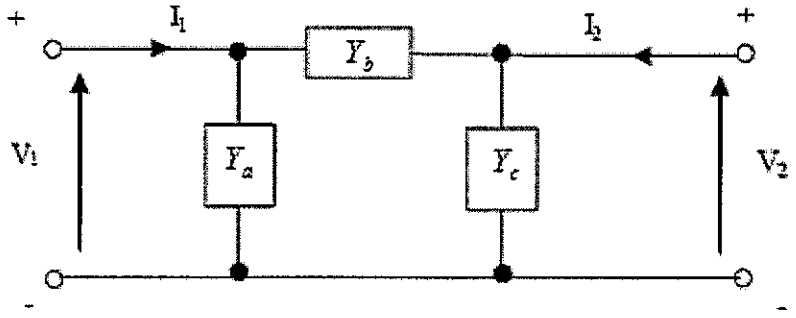


Figure 4(b)

Given $Y_a = 0.1S$;
$Y_b = 0.5S$;
$Y_c = 0.8S$.

(10 marks)

**Continued...**

**QUESTION 5 [20 marks]**

(a) Test whether the polynomial $P(s) = s^4 + s^3 + 7s^2 + 3s + 4$ is Hurwitz. State the reasons to prove if it is strictly Hurwitz or not Hurwitz.

(10 marks)

(b) Find the network for the following expression by using Cauer first form.

$$Z(s) = \frac{s^4 + 4s^2 + 3}{4s^3 + 10s}; \text{ for an LC network}$$

(10 marks)

**End of Page.**

## APPENDIX

$$\beta_k = \frac{1}{k!}\left(\frac{d^k}{ds^k}\right)\left[(s+a)^r F(s)\right]_{s=-a}$$

## TABLE OF LAPLACE TRANSFORM PROPERTIES

| $f(t)$ | $F(s)$ |
|---|---|
| $\delta(t)$ | $1$ |
| $u(t)$ | $\frac{1}{s}$ |
| $tu(t)$ | $\frac{1}{s^2}$ |
| $1$ | $\frac{1}{s}$ |
| $t$ | $\frac{1}{s^2}$ |
| $t^n$ | $\frac{n!}{s^{n+1}}$ |
| $e^{at}$ | $\frac{1}{s-a}$ |
| $\sin \omega t$ | $\frac{\omega}{s^2+\omega^2}$ |
| $\cos \omega t$ | $\frac{s}{s^2+\omega^2}$ |
| $e^{-at}\sin \omega t$ | $\frac{\omega}{(s+a)^2+\omega^2}$ |
| $e^{-at}\cos \omega t$ | $\frac{(s+a)}{(s+a)^2+\omega^2}$ |
| $t\sin \omega t$ | $\frac{2s\omega}{(s^2+\omega^2)^2}$ |

| | |
|---|---|
| $Af(t)$ | $AF(s)$ |
| $f_1(t) \pm f_2(t)$ | $F_1(s) \pm F_2(t)$ |
| $f(at)$ | $\frac{1}{a}F\left(\frac{s}{a}\right)$ where, $a > 0$ |
| $f(t-t_0)u(t-t_0)$ | $e^{-t_0 s}F(s)$ |
| $f(t)u(t-t_0)$ | $e^{-t_0 s}L[f(\lambda+t_0)]$ |
| $e^{-at}f(t)$ | $F(s+a)$ |
| $\frac{d^n F(s)}{dt^n}$ | $s^n F(s) - s^{n-1}f[0] - s^{n-2}f^2[0] \ldots s^n f^{n-1}(0)$ |
| $tf(t)$ | $-\frac{dF(s)}{ds}$ |
| $\frac{f(t)}{t}$ | $\int_s^\infty F(\lambda)d\lambda$ |
| $\int_s^\infty f(\lambda)d\lambda$ | $\frac{1}{s}F(s)$ |
| $\int_s^\infty f_1(\lambda)f_2(t-\lambda)d\lambda$ | $F_1(s)F_2(s)$ |

## SYNTHESIS OF LC NETWORK

The partial fraction expansion of an LC function using First Foster form:

$$F(s) = \frac{K_0}{s} + \frac{2K_2 s}{(s^2+\omega_2^2)} + \ldots\ldots\ldots + K_\infty s$$

## SYNTHESIS OF RC & RL NETWORK

The partial fraction expansion of an RC function using First Foster form:

$$Z(s) = \frac{k_0}{s} + \frac{k_2}{(s+\sigma_2)} + \frac{k_4}{(s+\sigma_4)} + k_\infty = \frac{k_0}{s} + \sum_{i=2,4,6}^{n} \frac{K_i}{(s+\sigma_i)} + k_\infty$$